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The following information has been provided on the "Kreis" transmission:

1. The "Kreis" transmission named after the designer Fritz Kreis is a gear transmission with full automatic gear shifts except for the reverse position. Three-speed transmissions for passenger cars were so far manufactured. They can be substituted for the conventional clutch gear unit in most passenger cars.
2. No reports have been received on the installation of "Kreis" transmissions in Soviet tanks although this can be done at any time.
3. The "Kreis" transmission (see Annex 1) is a purely mechanical cluster gear improved by centrifugal and freewheel clutches. Shifting of the three forward speeds is done by a fully-automatic mechanism and depends on the rate of speed. The proper adjustment of the mechanism ensures the complete tractive power of the engine. Gear shifting is done smoothly and without loss of gas. Without applying brakes, a special reverse idler gear device stops and restarts the vehicle for mountain climbing. Driving is done only by applying the gas pedal.
4. The three centrifugal clutches are interconnected in the clutch casing (Annex 1, left side). The clutch units are flanged to the crankshaft of the engine and simultaneously serve as flywheel. By two hollow shafts and one continuous shaft, the clutches are connected with the respective gear wheels and the cardan shaft (in direct motion).
5. The first gear shift (Annex 3 and 4) is released directly from the crankshaft. It is a single internal shoe-centrifugal clutch with the individual parts (shoe with clutch lining) serving as fly weights. They are held together by a recessed helical spring (garter spring). After the idling speed is passed the fly weights overcome the force of the helical spring and press against the internal side of the casing.

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The gear shift then slides in very smoothly. With an increasing number of revolutions the gear shift secures a rigid connection by its quadratically increasing adhesion. The operated gear shift transmits its motion to the countershaft by a hollow shaft and the first twin gear wheels, then to the cardan shaft and on to the car itself by the driving twin gear wheels. In the driving gear wheels (Annex 2, first gear shift) are freewheel catches which are in jamming position when driven by the engine but are released when driven by the cardan shaft. It indicates that freewheeling of the vehicle is always connected with the first gear shift. Stepping on the gas pedal means: clutching in and starting; releasing the gas pedal: declutching and freewheeling.

6. The running center gear wheel of the countershaft drives the gear wheel of the main shaft which is connected with the centrifugal clutch of the second gear shift by another hollow shaft. The clutch is a special design (Annex 3 and 5) with three helical springs and axially moving clutch plates. It is therefore not driven by the engine but by the countershaft with geared-down revolutions. It is adjusted to clutch in as soon as the first gear shift has reached its top speed. The fly weights overcome the force of the helical springs and the clutch compression springs slide in the gear shift by means of thrust balls. The center twin gear wheel is then driven (Annex 2, second gear shift). The greater transmission results in a quicker motion of the countershaft thus outrunning the first freewheel and the first gear shift. As the first freewheel is released, the first gear shift remains ready for operation. It sets in as soon as the speed is lowered and the second gear shift is automatically released.
7. The third gear shift (Annex 3 and 5) is at the side of the main shaft (direct motion) which is next to the engine. It has the same design as the second gear shift. It is directly driven by the main shaft and thus by the cardan shaft. As soon as the cardan shaft reaches the required number of revolutions, the third gear shift clutches in while the second freewheel permits overtaking the second gear shift. (Annex 2, third gear shift).

All three gear shifts are now in operation. The third gear shift is released with decreasing speed, and power transmission is taken over automatically by the second and then the first gear shift.

8. The technical design of the centrifugal clutches of the first and second gear is significant. It is characteristic of these clutches that the declutching mechanism operates at a lower number of revolutions than the clutching-in mechanism. This results in an overlapping position preventing fluctuation of the different gear shifts. The overlapping period can be reduced by back-throttling the gas pedal. The centrifugal arm and devices of the clutches for the first gear shift have a radial effect. The proper declutching and clutching-in process is produced by compression springs placed in axial boreholes of the arm devices. While resting the balls at the end of the compression springs press against the

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walls of the rim on both sides. As soon as the arming devices move, the boreholes pass the edge of the rim. The balls then are thrust on both sides into the clutch ring and effect a radial pressure on the counter ring which is flanged to the engine flywheel. Thus the clutch of the gear is let in. Declutching is not possible at the same number of revolutions but only at a reduced speed because the edge of the rim prevents the backrun of the balls. This requires an increased centripetal force counteracting the motion of the centrifugal arming devices. The three helical springs coiled around the arming devices can only effect this centripetal force, if the counter force i.e. the centrifugal force is further reduced. The driving speed must be reduced to bring about this mechanical process.

9. As the forward gears are operated automatically there is only a small hand lever on the instrument board, which operates the reverse gear and can also release a freewheel catch, if the second gear shift is needed for the braking effect in down-hill motion. The engine can also be thrown into this gear by downhill towing of the vehicle. The third gear shift slides in directly without preceding freewheel position. It has the same engine brake effect as in conventional transmissions. The hand-lever also has a neutral adjustment for running the engine at a high number of revolutions without moving the vehicle.
10. Another feature of the Kreis transmission is its reverse gear catch needed for uphill motion. A third freewheel (Annex 1 and 2, second gear shift) with an opposite rotary effect serves this purpose. If the car has the tendency to roll back from an uphill stop, the third and second freewheel are blocked and the vehicle is propped against the short intercalated shaft piece. If the throttle is closed, this freewheel also effects a clamp connection between the cardan shaft and the driving pinion of the second gear, thus preventing the clutch within the range of the second gear shift to be disengaged for otherwise the decrease of speed would result in a gear change.

11. The Kreis transmission has the following characteristics:

Automatic shifting of all forward speeds
 Lack of jerkiness in climbing starts
 Automatic adjustment of the transmission to all speeds and tractional resistances
 Economical fuel consumption
 Simple operation.

- 5 Annexes:
1. "Kreis" Transmission
 2. Gear Shifts
 3. Centrifugal Clutches
 4. " " , Gear Shift No.1
 5. " " , Gear Shift No.3 and 4.

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Annex 1

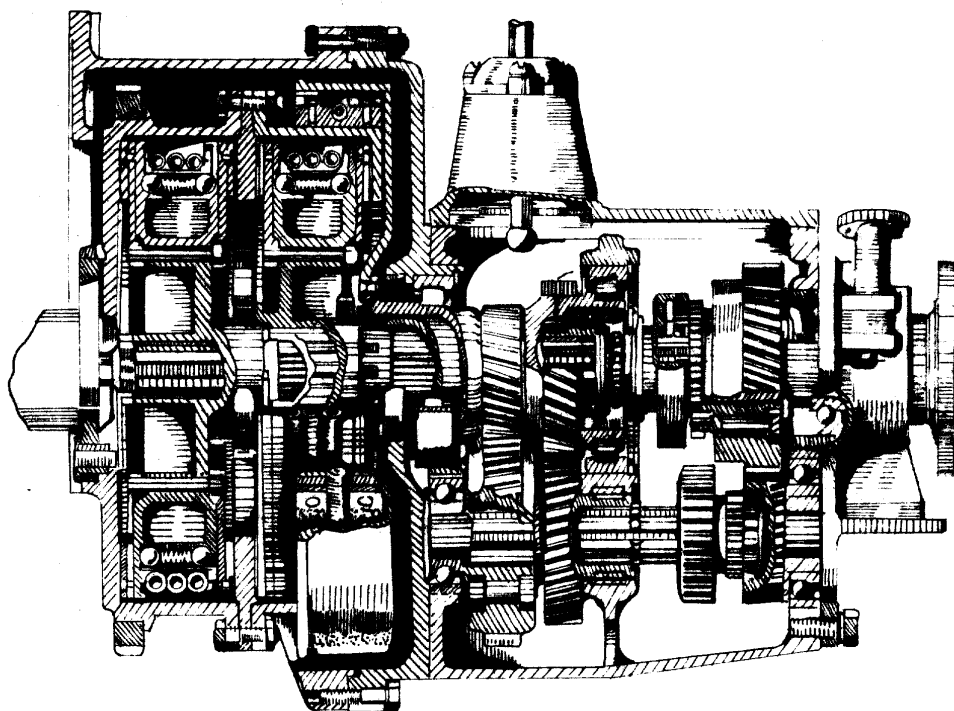
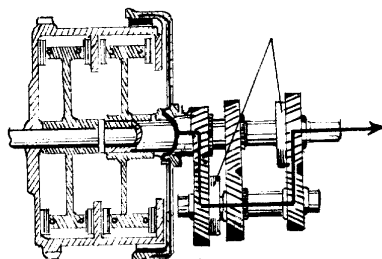
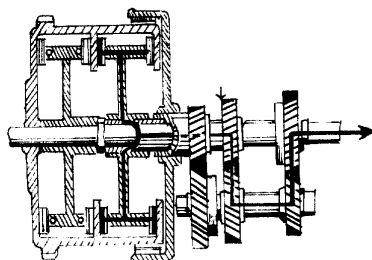
Three-Speed Gear of 2.5-Liter Engine

Diagram of the Transmission Mechanism

1st gear shift

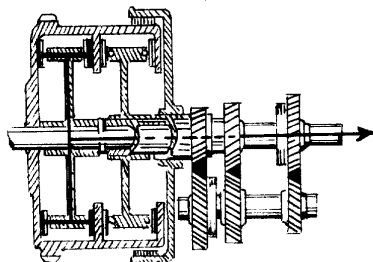
gear wheels with freewheel
(1 left and 2 right)

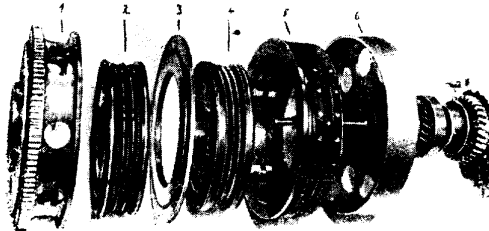
2nd gear shift



gear wheel with freewheel

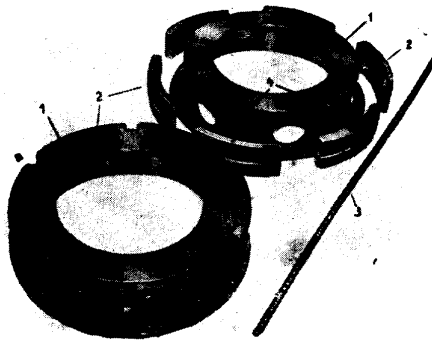
3rd gear shift





Legend to Annex 3: Centrifugal clutches

- (1) Engine side -section of gear shift No.3
- (3) " " " " shifts No.2 & 3
- (5) " " " " shift No.1
- (2) Cardan side-section of gear shift No.3
- (4) " " " " No.2
- (6) " " " " No.1



Legend to Annex 4: Centrifugal clutch, gear shift No. 1

- (1) Clutch suspension ring
- (2) Section with clutch lining
- (3) Helical spring
- (4) Guide bolt

Legend to Annex 5: Centrifugal clutch, gear shift No. 3 & 4

- (1) Clutch suspension ring
- (2) Clutch plates with clutch lining
- (3) Flyweights
- (4) Helical wprings
- (5) Compression springs
- (6) Thrust balls

